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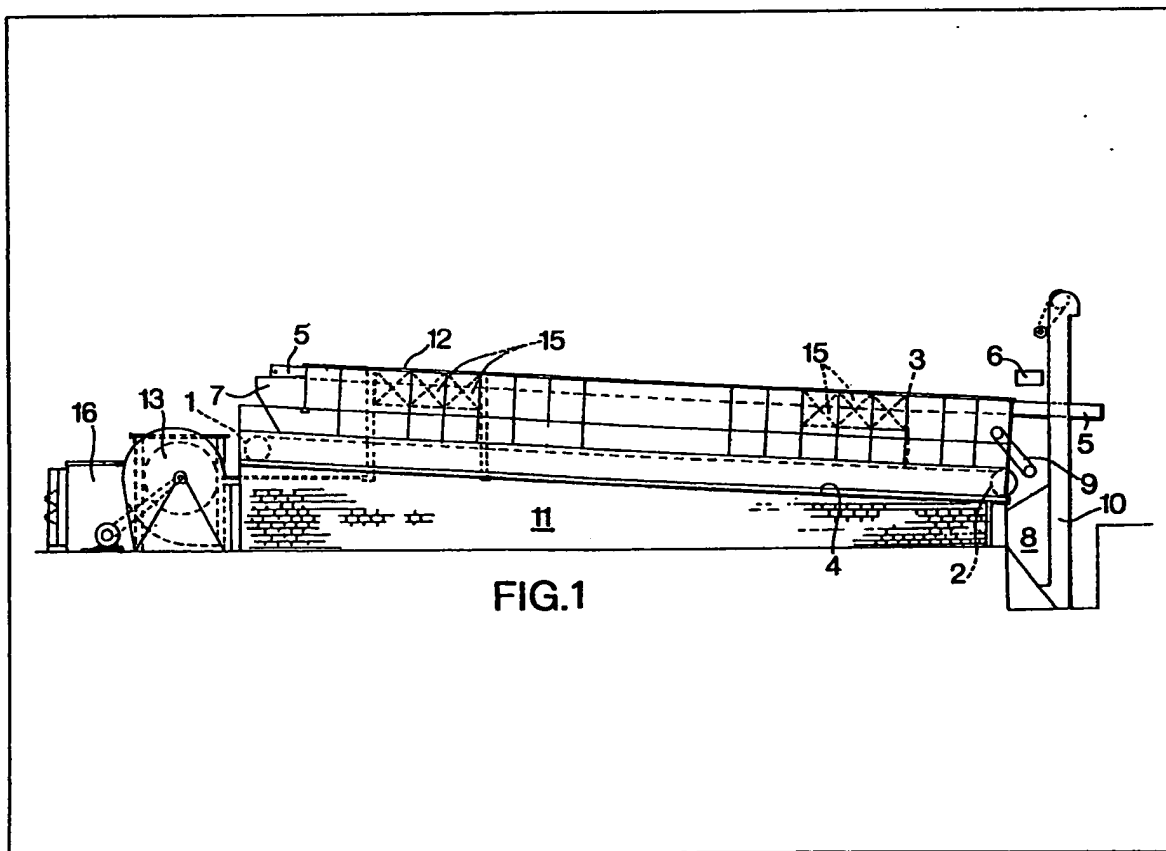
Walford & Hardman
Brown

(54) Movable bed malting apparatus

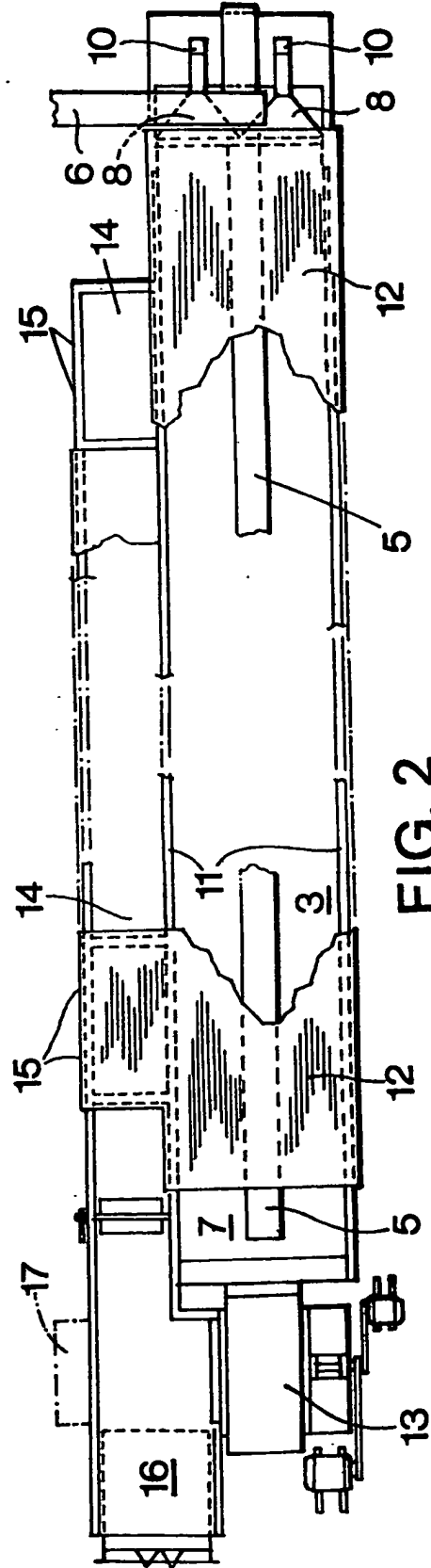
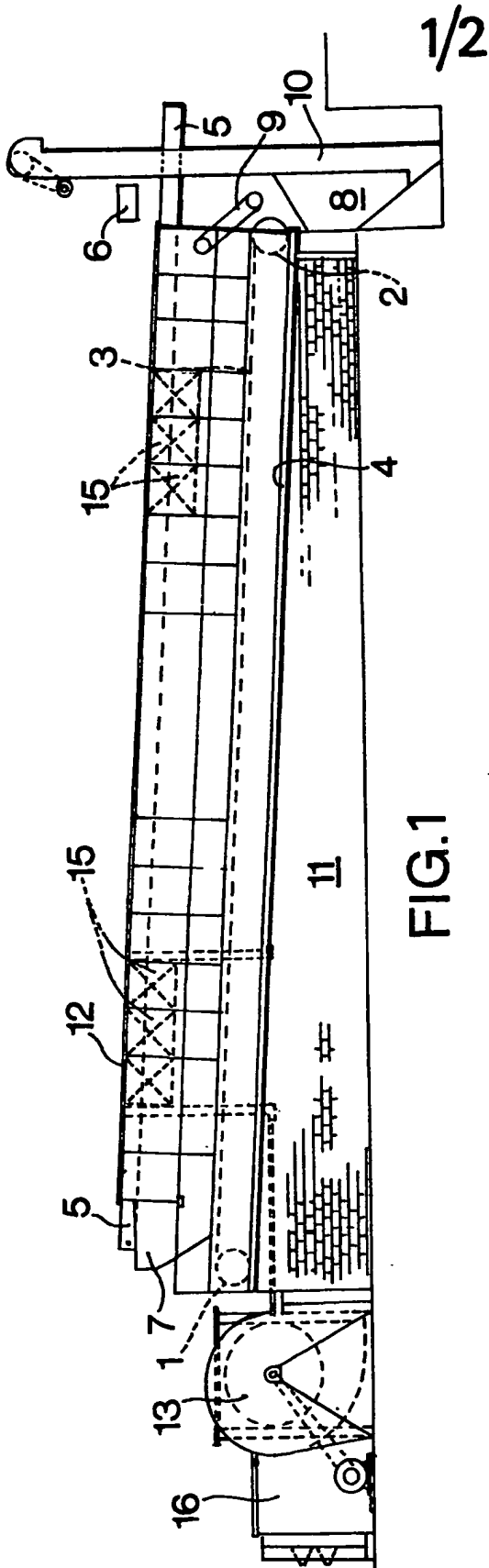
(57) A malting apparatus for grain comprises a movable bed formed by an endless louvred or perforated belt arranged with an upper run defining a bed (3) for the grain and a lower run (4) being a return run, a fan (13) for passing air, having required temperature and humidity, through at least the upper run (3) of the belt, a conveyor (5) (endless belt or auger) positioned above the upper run (3)

and extending substantially from one end of that run to the other, whereby grain introduced into the conveyor (5) adjacent the discharge end of the run (3) is carried by the conveyor (5) and is discharged from the remote end thereof onto the inlet end of the run (3), an elevator (10) for receiving grain discharged by allowing it to fall from the discharge end of the run (3) and operable selectively to return the discharged grain either to the inlet end of the conveyor or to deliver the discharged grain externally,

means for driving the belt and the conveyor, and means for varying the temperature and humidity of the air to be passed through at least the upper run (3) of the belt.



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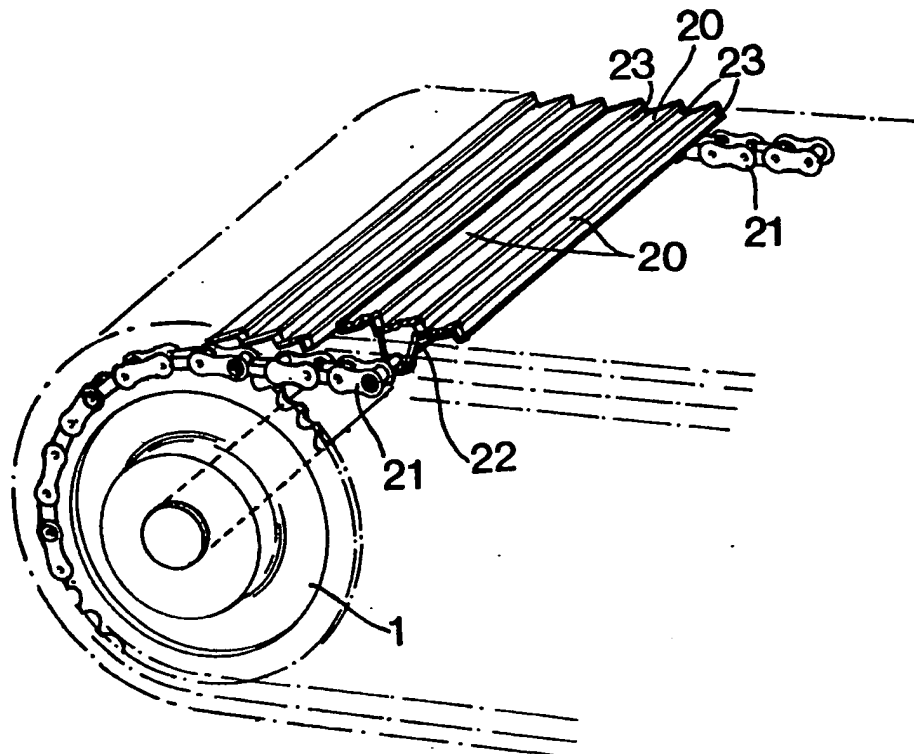


FIG. 3

SPECIFICATION

Movable bed malting apparatus

The invention relates to movable bed malting apparatus and is particularly concerned with a movable bed grain drier which can be used for the malting of barley or other grain by effecting in the drier the germination of steeped grain to be malted and which may additionally be used for the subsequent kilning of the germinated grain.

- 10 In malting, grain discharged from a steeping vessel is spread out in a bed through which air is passed under the conditions of temperature and humidity required to effect germination of the steeped grain. During germination, the grain may grow roots which tend to become intertwined to produce a mat. The intertwining of the roots to produce a mat should be avoided and can be prevented by turning the grain periodically. Turning of the grain also tends to achieve
- 20 uniformity of treatment. One way of turning the grain is to allow it to tumble from the bed. The grain, after tumbling can then be recirculated through the bed, where germination is insufficient and has to be continued, or to enable the
- 25 germinated grain to be kilned.

- A movable bed grain drier having at least a pair of movable beds may be used for germination, where grain is permitted to tumble or fall from the first bed to the second bed, as the falling of the grain would prevent the formation of a mat of germinated or partly-germinated grain; but a movable bed grain drier having only one bed could not be used unless means are provided to recirculate germinated or partly-germinated grain falling from the discharge end of the bed to the inlet end or to another drier.
- 30

- An object of the invention is to provide as malting apparatus, a movable bed grain drier having only one bed with means for returning grain falling from the discharge end of the bed to the inlet end thereof for further germination or for kilning or to another drier in which the kilning operation can be effected.
- 40

- According to the invention, malting apparatus comprises a movable bed formed by an endless louvred or perforated belt arranged with one run above the other, the upper run defining a bed for the grain and the lower run being a return run, means for passing air, having required
- 50 temperature and humidity, through at least the upper run of the belt, a conveyor positioned above the upper bed-defining run and extending substantially from one end of that run to the other, whereby grain introduced into the conveyor adjacent the discharge end of the bed-defining run is carried by the conveyor and is discharged from the remote end thereof onto the inlet end of the bed-defining run, an elevator for receiving grain discharged by allowing it to fall from the discharge end of the bed-defining run and operable selectively to return the discharged grain either to the inlet end of the conveyor or to deliver the discharged grain externally, means for driving the belt and the conveyor, and means for varying the
- 60

- 65 temperature and humidity of the air to be passed through at least the upper run of the belt.

- By providing the required conditions of temperature and humidity and by appropriate operation of the belt and the conveyor, grain from a steeping vessel may be delivered to the inlet end of the conveyor, conveyed thereby to the bed-defining run of the belt and spread by movement of the latter into a bed, germinated or partly-germinated while on the bed-defining run, allowed to fall from the discharge end of the bed-defining run, carried by the elevator and either discharged onto the conveyor or externally of the drier. Where the grain received by the elevator has not been sufficiently germinated, it would be returned to the conveyor for a second or subsequent germination pass through the bed-defining run. Where the grain received by the elevator has been sufficiently germinated, the elevator may discharge the germinated grain to the conveyor and in that case kilning would be effected by passing air through the grain on the bed-defining run at the required temperature.
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- 75
- 80
- 85

- Alternatively, the germinated grain may be discharged by the elevator externally of the apparatus, where kilning is to be effected in external apparatus, such as a grain drier.
- 90

- The belt and the conveyor may be arranged to be driven individually or together, either in unison or at different speeds. The conveyor may be of the endless belt type or another type of conveyor, e.g., an auger.
- 95

- The belt in its return run may be engaged by a brush or other cleaning means to remove any grain which may have been retained thereon after the belt has left the bed-defining run.
- 100

- By way of example, movable bed malting apparatus in accordance with the invention is now described with reference to the accompanying drawings, in which:—
- 105

- Figure 1 is an elevation of a movable bed grain drier, which is to be employed as the malting apparatus;

- Figure 2 is a plan view of the drier shown in figure 1, and

- Figure 3 is a perspective view of a portion of the movable bed.
- 110

- The drier comprises a movable bed in the form of an endless belt supported on end drums or sprockets 1, 2 to form an upper bed-defining run 3 and a lower return run 4. One of the drums or sprockets 1, 2 is driven. The endless belt may be in the form providing a louvred floor of which the louvres extend between louvre sections 20 transversely of the belt (See Figure 3) or a perforated sheet floor. Where the endless belt forms a louvred floor, the louvre sections 20 (as shown in Figure 3) would be supported by a pair of parallel endless chains 21 supporting longitudinally-spaced parallel slats 22 between them. The louvre sections 20 would be supported in groups of, say, three by each slat 22, one of the louvre sections 20, for example, the centre one in a group of three, being pivoted to the slat 22 about an axis parallel to the slat to enable the
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- 120
- 125

complet belt to pass around the end drums or sprockets 1, 2 while the gap between adjacent louvre sections is maintained substantially constant. The belt is arranged with at least its upper run 3 inclined downwardly from the inlet end to the discharge end thereof and with the louvre sections 20, where provided, defining gaps 23 therebetween facing in the direction downwardly of the bed-defining run 3.

10 Above the bed-defining run 3 there is a conveyor 5, which may be of the endless belt type, extending through substantially the whole length of the bed-defining run 3. The conveyor 1 is supplied with grain from a transverse conveyor 6 above the discharge end of the bed-defining run 3 and is arranged to discharge grain at the remote end thereof through a hopper 7 to the inlet end of the bed-defining run 3.

20 The discharge end of the bed-defining run 3 is arranged to discharge grain into one or more hoppers 8. The discharge is controlled by a discharge rake device, for example, a short endless conveyor 9. The hoppers 8 discharge into an elevator or elevators 10 which may either discharge grain onto the inlet end of the conveyor 5 or externally of the drier.

30 The belt 3, 4 and the conveyor 5 are enclosed within a housing defined by side walls 11 and a roof 12 to which air is supplied by a fan 13. Air from the fan 13 is introduced into the housing beneath the belt 3, 4 and passes through the upper run 3 of the belt and a bed of grain defined on the upper run 3 and passes into a duct 14 at the side of the housing, from which air may be recirculated to the underneath of the belt runs. The duct 14 is provided with removable or openable exhaust doors 15 at positions in its length. By removing or opening some of the exhaust doors 15, the flow of air and its recirculation through the bed can be controlled. An air inlet duct 16 leads to the fan 13 from a furnace and also communicates with a humidifying unit 17. The temperature and humidity of the air supplied are controllable.

45 The drier shown in Figures 1 and 2 is particularly intended to effect germination of grain required for malting. Grain from a steeping vessel is supplied on the conveyor 6. This discharges the steeped grain onto the conveyor 5. The conveyor 5 is driven by means not shown and transfers the steeped grain to the hopper 7. From there the steeped grain falls onto the upper run 3 of the louvered or perforated belt and by appropriately driving the belt, a bed of grain is formed on the upper run 3. A grain levelling device, not shown, may be provided at the inlet end of the upper run 3. Heated humid air is passed through the bed of grain, usually while the belt and the conveyor 5 are stationary. At the end of the germination period, the belt is restarted and the germinated or partly-germinated grain is turned by falling off the upper run 3 into the hoppers 8. This turns the germinated grain and so prevents the formation of a mat of roots, if grown, and improves uniformity

65 of treatment. The elevators 10 then raise the grain to a height above the conveyor 5. If the grain has not been sufficiently germinated, it may be discharged onto the conveyor 5 and be recirculated through the drier. If the grain has been sufficiently germinated, it then has to be kilned. 70 This may be performed in the drier by re-adjusting the temperature of the air. When a bed of grain to be kilned has been formed on the upper run 3, the drives to the belt and the conveyor 5 are stopped or the speed of the belt is controlled, to effect the kilning step. Alternatively where the kilning is to be effected in another drier or other apparatus, the elevators 10 would be discharged to another conveyor, instead of the conveyor 5, or to a container. 80 The louvered or perforated belt may be cleaned of grain by passing the lower return run of the belt over a brush or other cleaning device.

CLAIMS

1. Malting apparatus comprising a movable bed 85 formed by an endless louvered or perforated belt arranged with one run above the other, the upper run defining a bed for the grain and the lower run being a return run, means for passing air, having required temperature and humidity, through at least the upper run of the belt, a conveyor position 90 above the upper bed-defining run and extending substantially from one end of that run to the other, whereby grain introduced into the conveyor adjacent the discharge end of the bed-defining run is carried by the conveyor and is discharged from 95 the remote end thereof onto the inlet end of the bed-defining run, an elevator for receiving grain discharged by allowing it to fall from the discharge end of the bed-defining run and operable 100 selectively to return the discharged grain either to the inlet end of the conveyor or to deliver the discharged grain externally, means for driving the belt and the conveyor, and means for varying the temperature and humidity of the air to be passed through at least the upper run of the belt. 105

2. Apparatus as claimed in Claim 1 in which the belt and the conveyor are arranged to be driven individually by separate driving means.

3. Apparatus as claimed in Claim 1 in which the belt and the conveyor area arranged to be driven by common driving means. 110

4. Apparatus as claimed in Claim 3 in which the belt and the conveyor are arranged to be driven by said common driving means in unison.

5. Apparatus as claimed in Claim 3 in which the belt and the conveyor are arranged to be driven by said common driving means at different speeds. 115

6. Apparatus as claimed in any preceding claim in which the conveyor is of the endless belt type.

7. Apparatus as claimed in any one of Claims 1 to 5 in which the conveyor is an auger. 120

8. Apparatus as claimed in any preceding claim in which the belt in its return is engaged by a

brush or other cleaning means to remove grain which may have been retained thereon after the belt has left the bed-defining run.

9. Apparatus as claimed in any preceding claim

5 being a movable bed grain drier.

10. A movable bed grain drier constructed and arranged substantially as described herein and shown in the accompanying drawings.

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